A Story of Biological Control

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A loosestrife leaf-feeding beetle (*Galerucella calmariensis*): the bane of purple loosestrife

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Loosestrife leaf-feeding beetle eggs

With its showy purple flowers, purple loosestrife (*Lythrum salicaria*) is a beautiful plant, but here in the United States it's also a big problem! During the 1800s, it was imported from Europe for flower gardens. Seeds of purple loosestrife were also present in the ballast holds of European ships that used soil to weigh down the vessels for stability on the sea. In time, the plant began to spread, primarily by seed dispersal, through the northern wetlands of the United States and southern Canada. It sounds hard to believe, but a single mature plant can produce up to 2.7 million seeds annually! Once purple loosestrife gets established in a wetland it will typically spread rapidly and eventually prevent native plants from growing. The resulting loss of plant diversity further limits the number of animal species that find accommodating habitat in the infested wetland. People may enjoy viewing a "sea of purple" from a spreading loosestrife monoculture, but the fact remains that the plant's aggressive growth inevitably reduces biodiversity.

For a number of years prior to 1995, the Great Swamp National Wildlife Refuge (NWR), in Morris County, New Jersey, attempted to control purple loosestrife by spraying it with the herbicide glyphosate. Normally, one or two refuge biologists would spend from six to eight weeks each summer walking through the marshes with backpack sprayers. Despite the effort, it was very difficult to keep up with the tremendous seed production and germination of new plants.

During those years of spraying, refuge biologists kept abreast of the research that was being conducted on potential biological control for purple loosestrife. Researchers were trying to determine if any of the insects that controlled purple loosestrife in Europe could be introduced into North America without causing a secondary problem. Although it was discovered that over 20 insects feed on purple loosestrife in Europe, only five of those species completed their whole life cycle solely on purple loosestrife. The United States Department of Agriculture agreed to allow those five species into the United States for bio-control of purple loosestrife.

A stalk of purple loosestrife (*Lythrum salicaria*)
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In 1995, the Great Swamp NWR stopped spraying and began raising and releasing two of the five species, specifically the leaf-eating beetles. Although the refuge continued to release thousands of beetles each spring, for a number of reasons the beetle population in the field increased slowly. The beetles normally lay their eggs in the developing stem tips, and that is exactly the part of the loosestrife plant that white-tailed deer relish eating! Also, the refuge frequently received prolonged spring flooding that drowned the beetles' eggs, and fall flooding that drowned the overwintering adults. Even under normal circumstances only about 20% of the adults survive through the winter!

Nevertheless, each summer refuge personnel observed more beetles on the plants. Yet despite slowly increasing plant damage, the purple loosestrife continued to spread in the absence of chemical control. By 1998, the refuge was wondering if the beetles could actually control loosestrife at Great Swamp and if it would be necessary to start spraying again. However, in 1999, the beetles completely consumed a quarter acre of loosestrife. Encouraged, the refuge decided to continue with the bio-control program for another year. The beetles consumed 3 acres in 2000, 13 acres in 2001 and 40 acres in 2002. In 2003, because flooding drowned many beetle larvae, only 20 acres were consumed, but this is almost certainly a temporary setback. We expect that the purple loosestrife at Great Swamp NWR should be under control in two to three years!

Native cattails (*Typha* spp.), smartweeds (*Polygonum* spp.), and sedges (*Carex* spp.) are replacing the loosestrife. The refuge no longer needs to raise and release beetles and is shifting its invasive plant control efforts to Japanese barberry (*Berberis thunbergii*) and Japanese knotweed (*Polygonum cuspidatum*). It looks as if Great Swamp's biological control of purple loosestrife is going to be a success story after all!

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Purple loosestrife as monoculture